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ABSTRACT

Designed to culminate an ornamental horticulture class, this teaching guide provides information needed for the year-round operation of a school and/or commercial greenhouse. Three units are presented: production schedules, determining harvest time, and cost analysis. Each unit lists major teaching points, learning activities, and reference materials. Included in the appendixes are crop production schedule information for twenty-three annuals, seven perennials, ten vegetables, ten flowering pot plants, and thirteen foliage plants. Also provided in the appendix is cost analysis information, including general cost information, a sample student problem, and specific cost information for six different plants. (JH)

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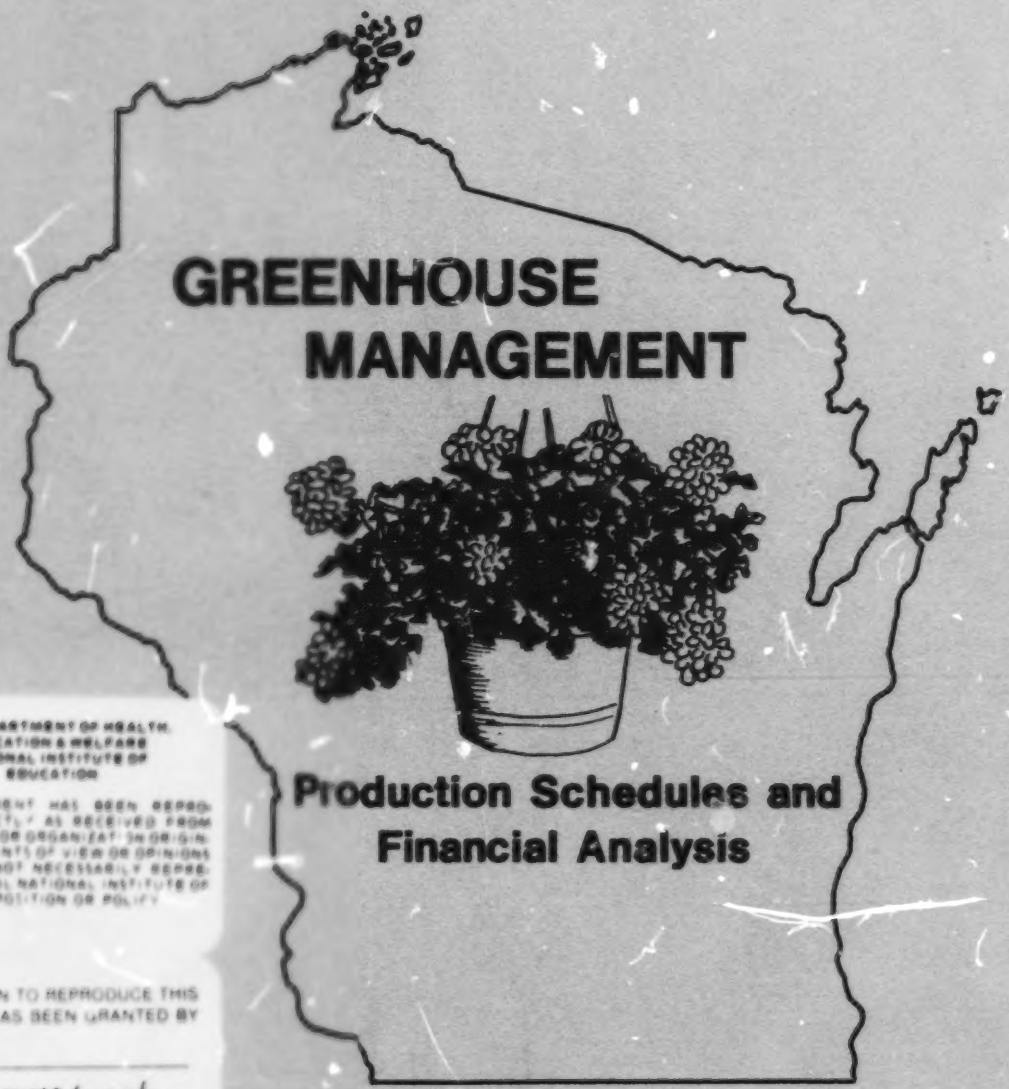

GREENHOUSE MANAGEMENT

Production Schedules and Financial Analysis

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This unit is one of several developed during a curriculum workshop conducted during the summer of 1976 at the University of Wisconsin-River Falls. The purpose of the workshop was to develop instructional units from which instructors of vocational agriculture could teach with a minimum of additional preparation. Emphasis was placed on the designation of information to be taught and upon learning activities related to the instruction. Specific illustrations, problems and sources of reference materials were developed. This resource unit was developed in cooperation with the Wisconsin Department of Public Instruction and the University of Wisconsin-River Falls. It was funded under Part C, Vocational Education Act of 1963, as amended in 1968.

GREENHOUSE MANAGEMENT:

Production Schedules and Financial Analysis

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GREENHOUSE MANAGEMENT:

Production Schedules and Financial Analysis

Introduction

This unit is to be used to culminate an ornamental horticulture class and deals specifically with greenhouse production schedules and cost analysis. The authors assume that students will have previously received instruction in basic greenhouse skills. This unit provides the necessary data to provide for the year-round operation of a school and/or commercial greenhouse.

Objectives

Given instruction, the student will be able to:

1. Organize a 12-month production schedule for a given greenhouse which will result in weekly sales and achieve 90 percent utilization of growing space.
2. Determine production schedules which will result in proper harvest timing for horticultural crops and determine a production schedule for any common greenhouse crop which will result in 90 percent of the crops being saleable.
3. Complete a cost-analysis for any horticultural crop on the determined schedule.

Production Schedules

I. Objective: Organize a 12-month production schedule for a given greenhouse which will result in weekly sales and achieve 90 percent utilization of growing space.

A. Major Teaching Points

1. A 12-month production schedule is important for smooth and efficient greenhouse management:

a. We need to provide efficient utilization of greenhouse space. (With the current high cost of greenhouses it is vital to use all the square feet available.)

(1) Rigid glass or fiberglass: $12.00/sq. ft. (1976).

(2) Poly plastic: $4.25/sq. ft. (1976).

(3) Heating and overhead costs: 35¢/sq. ft./mo.

b. We want to even out peak periods of labor by having a constant labor flow throughout the year.

c. A continuous cash flow is needed to provide capital for making the business profitable.

(1) Less borrowed dollars to meet payroll demands and production materials.

(2) Take advantage of cash discounts when purchasing materials.

(3) You are in a secure position to borrow additional capital when needed.

(4) Through continuous marketing you are able to level out the peaks and valleys of price fluctuations.

d. Through a good production schedule, you will be able to re-invest your capital thus operating on a smaller margin

of profit. (The more times the money is turned over, the less profit you need for each time it is used.)

B. Learning Activities

1. Compare and contrast the cost per square foot of the following greenhouse structural materials:
   a. Aluminum glass structure (ref. C.1 and C.2)
   b. Aluminum fiber glass structure (ref. C.1 and C.2)
   c. Poly plastic (ref. C.1 and C.2)
2. Survey three area greenhouses to determine their heating and overhead costs per square foot.
3. Survey three area greenhouses and determine the three peak months of labor use, the three months of lowest labor use and the average of the year.
4. Check with the local bank and determine the advantages of borrowing short term credit vs. long term credit.
5. Using the figures arrived at in No. 3 above, determine the amount of money lost if your business had to borrow money to pay the labor during the three peak months (use local interest rates as found in No. 4 above).

Example:

		Hrs.	
	Jan.	1345	
	Feb.	1400	
High	Mar.	1450	
	Apr.	1470	Ave. 1467
	May	1480	
	June	1300	
Low	July	1220	
	Aug.	1240	Ave. 1232
	Sept.	1235	
	Oct.	1275	
	Nov.	1280	
	Dec.	1300	
	Ave.	1330	Average Wage: $2.50/hr.

High Ave.-Yearly Ave. = Excess Labor/mo.
Excess Labor x 3 (high months) x Wage = Borrowed Money
Money borrowed x Interest rate x ¼ (or 3 mo./12) = added expenses

Example:

1467-1333 = 134
134 x 3 = 402 x 2.50 = $1005
$1005 x 10 x ¼ = $25.12 added expenses

6. Using an example of a $50,000.00 input determine the dollar advantage of having purchases in cash. (Use ref. C.1 and C.2).

7. Example problem:

Manager wants to make 1.5% on each transaction. Assuming he has seven transactions per year, what is the net interest for the entire year on his investment? (Formula: % per transaction x the number of transactions per year = net interest on investment.)

Example:

Assume 1.2% per transaction and 1.2 x 9 = 10.8 return per investment

(9 transactions per year--turn money over 9 times.)

C. Instructional Materials

1. George Ball Catalog, George J. Ball, Inc., P. O. Box 335, W. Chicago, Ill. 60185.

2. A. H. Hummert Seed Co. Catalog, A. H. Hummert Seed Co., 2746 Chouteau Ave., St. Louis, Mo. 63103.

Determining Harvest Time

II. Objective: Determine production schedules which will result in proper harvest timing for horticultural crops.

A. Major Teaching Points

1. It is important to time horticultural crops so they can be sold at the proper time.
2. Seasonal crops need to be at their peak at the proper time (Easter Lilies are of little value after Easter).
3. Timing will result in an even flow of labor, capital, and space for maximum year around production.
4. Timing of a crop can reduce expense by taking advantage of climatic conditions for proper growth.

   i.e., foliage in summer when greenhouse is naturally warm; primula in winter when heat is most costly, long day photoperiod plants in the spring and summer, low light plants in winter, etc.
5. Timing is affected by a large number of factors including:
   a. Sowing date.
   b. Germination temperature.
   c. Transplanting date.
   d. Growing temperature.
   e. Day length (amt. of light) photoperiod.
   f. Fertilizer feeding rates.
   g. Use of growth regulators.
   h. Pinching date.
   i. Disease and insect problems.
   j. Length of hardening period.

k. Amount of water.

(See Appendix A for information on specific crops.)

B. Learning Activities

1. Survey three area greenhouses and determine the following information for Easter Lilies and Poinsettia:

	Easter Lilies		Poinsettia	
	1977	1978	1977	1978
Potting Date				
Sales Period				

2. Compare the prices of the following items in a retail florist shop.

	Roses	Poinsettia
Before Valentine's Day		------
After Valentine's Day		------
Before Christmas Day	------	
After Christmas Day	------	

3. Experiment: Each student will have three precooled Easter Lily bulbs. One is to be planted December 31, the second, two weeks later and the third January 31. Bulbs are to be kept cool (40°F.) before planting. All bulbs are to be planted 1.5 inches deep in a 1:1:1 mix and grown in greenhouse. One-half of the class will grow at about 55°F., one-half at 60°F. night temperature. At Easter complete the following chart:

	55°F. Lilies			60°F. Lilies		
Planted	12/31	1/14	1/31	12/31	1/14	1/31
No. of days-4' tall						
No. of days-1st buds						
No. of days-1st blm.						
No. of days-full blm.						
Final height						
No. of blooms						

After completion of data, students should discuss:

a. The effect of temperature on the: (ref. C.2)

(1) Timing of Lily crop.

(2) Height.

(3) Number of blooms.

b. Is there a difference in the amount of time required for growth, budding and first bloom depending upon planting date? (Teacher's Note: With increasing light intensity, after December 21, the lily crop requires fewer days to mature. Thus the number of days for each stage of growth, would probably be less for the later planted bulbs.) (ref. C.2)

c. What could you as a greenhouse manager do if you found your Easter Lily crop ten days ahead of schedule on February 20th? (Teacher's Note: By cooling greenhouse night temperature to 5°F. or so lower than normal one could "hold" the crop a little longer by slowing down the growth. Too cool of a night temperature however can "stall" the crop making high heat necessary to force bloom and thus reducing the quality of the crop.) (ref. C.2)

4. Experiment: This experiment is designed to show students that certain crops germinate under different temperatures. (Teacher's Note: You are given two groups of temperature affected plants. Choose <u>one plant</u> out of <u>each group</u> and then have students complete the following table. Use a suitable germination mix and maintain the proper germination

temperature. This is, of course, critical. Even if you cannot maintain the growing temperature, the first part of the experiment should indicate how temperatures will affect timing. (ref. C.1)

Group A - 70°F.	Group B - 80°F.
Nicotiana	Mimosa
Calceolaria	Peppers
Carnation	

GERMINATION

	60°F.		70°F.		80°F.	
	A	B	A	B	A	B
Days to 1st emergence						
Days to 1st true leaf						
% germinated						
(TRANSPLANT INTO SUITABLE CONTAINERS						
Days to 3" high						
No. of leaves/stem inch						
Days to first flower (or saleable size)						

C. Instructional Materials

1. George Ball Catalog, George J. Ball Co., Box 335, W. Chicago, Ill. 60185.

2. Ball Red Book, ed. Vic Ball, George J. Ball, Inc., 12th ed. W. Chicago, Ill. 60185.

Cost-Analysis

III. Objective: Complete a cost-analysis for any horticultural crop.

A. Major Teaching Points

1. Determination of profit margin is important in the operation of a greenhouse:
   a. In making decisions on what crops to grow.
   b. In determining the size of plant to be grown.
   c. In determining price to be charged.
   d. In determining the best season for producing a given crop.
   e. In determining profit potential for greenhouse expansion.
   f. To utilize labor most effectively.
   g. In locating "weakness" in the production schedule or improving the profitability of the business.
2. What is involved in determining the profitability of a given crop? (See sample problem in Appendix B.)

B. Learning Activities

Using the sample problem and information in Appendix B, complete the necessary cost analysis to determine:

1. Whether Easter Lilies or African Violets have the highest profit potential per square foot per month.
2. Whether a 4" "Piggy Back" or a 6" "Piggy Back" produces the highest profit per square foot per month.
3. If you want to generate $15.00 per square foot per year in total sales, what price must you charge for peperomia?
4. The difference in profit per square foot per month when growing German Ivy for pot plants versus bedding plants.

5. If you have a greenhouse with 10,000 square feet of space, what is the profit potential compared to a greenhouse of 15,000 square feet? Use any two crops you wish with one-half of your space allocated to each.

6. If you want to add 5,000 square feet to your greenhouse, how many years will it take you to pay off your purchase, if growing 4" Jade plants? (See Appendix B.)

C. Instructional Materials

1. George Ball Catalog, George J. Ball Co., Box 335, W. Chicago, Ill. 60185.

2. George W. Park Co. Catalog, George W. Park Co., Inc., Greenwood, S. C.

3. Ball Red Book, ed. Vic Ball, George J. Ball, Inc., 12th ed., W. Chicago, Ill. 60185.

4. A. H. Hummart Co. Catalog, A. H. Hummart, 2746 Chouteau, St. Louis, Mo. 63103.

APPENDIX A

PRODUCTION SCHEDULE INFORMATION

SAMPLE

Ageratum (Floss Flower)

Annual	200,000 S	8-10 days	70° -75°
	↓	↓	↘
	Seeds per ounce	Germination time	Germination temperature in degrees Fahrenheit

I. Bedding Plants--Annuals

A. Ageratum (Floss Flower)

Annual, 200,000 S, 8-10 days, 70-75°. Sow February-March. Do not cover, use fluorescent light if not exposed to sunlight, growing temperature 60°. Sow in February for 4" pots and March for 12 pak of 6 per flat (72 plants).

B. Alyssum

Annual, 90,000 S, 8 days, 70°. Sow March-April. Do not cover, susceptible to damping-off, growing temperature 58°. Sell in 12 paks of 6 per flat.

C. Amaranthus

Annual, 44,000 S, 8-10 days, 70-75°. Above 70°, dry, bright light, water sparingly, 12 paks of 6 per flat. Sow March thru April. Will need pinching to maintain stockiness.

D. Asters

Annual, 12,000 S, 8-10 days, 70°. Sow 6 weeks before selling season, three weeks after sowing transfer to 2½" pots, or 12 paks of 6 per flat.

E. Bells of Ireland

Annual, 4,200 S, 3 weeks, 50° nights, 85° days. Sow 12 weeks before sales period. Prechilling at 50° for 5 days, do not cover seed. Transplant to 18 single cell paks per flat.

F. Browalla

Annual, 110,000 S, 15 days, 70°. Sow March, constant 70° soil temperature. Exposure to light helps germination, do not cover. Transplant into 12 paks of 6 per flat. Also make hanging baskets (5 per 8", 7 per 10", 9 per 12"). One or two pinchings for hanging baskets.

G. Begonias

Annual, 2,000,000 S, 2-3 weeks, 70°. Do not cover, must have 60° to keep moving. Sow December-January for May bedding. Sow in July for Christmas. For bedding use 12 paks of 6 per flat, for pots use 4" Azalea pots.

H. Celosia

Annual, 28,000 S, 8-10 days, 70°. At least 70° temperature for germination. Cover lightly when sowing, sow 6 weeks before sales. Grow at minimum of 60°. Sell in 12 paks of 6 per flat.

I. Cleome (Spider Plant)

Annual, 12,500 S, 10-12 days, 70° night, 85° day. Cover seed lightly when sowing, sow seed March-April for sale in 8 paks of 4 per flat.

J. Coleus

Annual, 100,000 S, 10 days, 65-75°. Sow February. Germination keep soil above 75°. No soil cover. Flower buds should be pinched out as they begin to form. Pinch (which can be stuck), most varieties to maintain stockiness. Sell in 12 paks of 6 per flat or 8 paks of 4 per flat.

K. Dusty Miller

Annual, variable, 10-15 days, 60-75°. Temperature for germination is specific to each type. Do not cover. Sow February-March for May bedding in 12 paks of 6 or 2½" pots.

L. Geraniums--Seed

Annual, 6,000 S, 3 weeks, 70-75°.

4" Pots--Sow December 21 at 70-75°. Transplant 2½-3 weeks later (January 19) into 4/8 cell paks. Treat soil the day before transplanting with Cycocel or A-Rest. (Cycocel is applied at 1 ounce of 3,000 ppm per cell (1 qt. per gallon of water). A-Rest is used at 1/4 milligram per cell or 1 ounce A-Rest to 1/2 gallon solution and applied 2 oz per cell before planting.

Transplant seedlings to treated soil and do not water in to avoid leaching of retardant. Let soil dry normally, then water and grow at 62° night.

Pot to 4" pots 8½ weeks after sowing date or about February 24. Continue 62° night minimum. First blooms mid-April.

4/8 Paks--Sow February 1 for Mother's Day and February 15 for Memorial Day. Follow other procedures as for pots above.

M. Impatiens (Sultanas)

Annual, variable, 18 days, 70°. Sow January-February. Maintain a uniform 70°. February 15 is latest date in order to get plants for early May sales. Pak sales in late May and early June can be sown until March 10. Growing temperature 58-60°. Sell in 12 paks of 6 per flat and/or hanging baskets. One pinch (which can be stuck) may be necessary on earlier plantings.

N. Lobelia

Annual, 700,000 S, 20 days, 70-75°. Keep constant 70° or higher for best germination. Do not cover seed, water with warm water. Require moderate shade. Grow in 12 paks of 6 per flat. Pinching maintains stockiness.

O. Marigolds

Annual, 9,000 S, 7 days, 70-75°. Sow 8-10 weeks before selling season for plants in 12 paks of 6 per flat. No pinching needed on most varieties.

P. Nicotiana

Annual, variable, 15 days, 70°. Constant 70° temperature for germination. Do not cover seed. Grow at 60°. Sow March 1 for 12 paks of 6 per flat and February 15 for 4" pots for mid-May. One pinch is beneficial on pot material.

Q. Nierembergia

Annual, 175,000 S, 15 days, 70°. Avoid temperature below 70°. Cover seed with light sifting of soil. Grow at 60°. Sell as 12 paks of 6 per flat and hanging baskets (5 per 8", 7 per 10", 9 per 12").

R. Pansies-Violas

Annual, 20,000 S, 10 days, 65-75°. Cover seed lighlty with soil. Mid-winter sowing in December or January. Transplant to 12 paks of 6 per flat or half flats. Grow in cool house not over 50°, 45° is better. Violas germinate best in total darkness. Sow about December 15 for April sales at 50° night temperature. Violas are perennials.

S. Petunia

Annual, 285,000 S, 10-12 days, 70-80°. Sow early in March for May bedding-plant sales if grown at 50°. Use 12 paks of 6 per flat. Use B-9 once or twice to reduce stem length. A pinch can be used to maintain stockiness.

T. Salvia

Annual, 7,500 S, 12-15 days, 70°. Do not cover, maintain uniform soil 70°. Sowing dates: February 1-15, 4 inch pots, for combinations
March 1-15, flowering 2½ inch pots for May sales
March 15-April 10 for pak and flat sales 12 paks of 6 per flat
Growing temperature 55-60°. One pinch will maintain stockiness if necessary.

U. Thunbergia

Annual, variable, 12 days, 70-75°. Keep soil uniform temperature above 70° for best germination. Cover seed ¼ inch of sowing medium. February 1 sowing will make full hanging baskets by mid-May. (Plant 7 per 10" and 10 per 12" basket, pinching once or twice--do not over water.) Sowings thru late March will make 12 paks of 6 per flat.

V. Verbenas

Annual, 10,000 S, 20 days, 65°. Sow germinates at 65° temperature, cover seed with ¼ inch, keep in dark, water soil night before sowing. Sow March 1-15 for 12 paks of 6 per flat sales.

W. Zinnias

Annual, variable, 7 days, 70°. Sow 4 weeks before selling time, grow in 60° night temperature. Early sowing result in unsaleably tall growth. Warning: Will not germinate in less than a 70° soil temperature. Cover seed 1/8 to 1/4 inch with soil. Sell in 12 paks of 6 per flat or 8 paks of 4 per flat. The Peter Pan varieties work best. These dwarf varieties require sowing 8 weeks before sales.

II. Bedding Plants--Perennials

A. Delphiniums

Perennial, 10,000 S, 18 days, 70° nights, 85° days. Cover lightly when sowing. Sow in January and grow at 50°. Sell as 18 or 22 individual cells per flat.

B. Dianthus

Perennial, 28,000 S, 10 days, 70-80°. Sow seed January-February. Use warm well drained soil and grow at 50°. Sell as 18 or 22 individual cells per flat.

C. Digitalis

Perennial, 180,000 S, 10 days, 70-80°. Sow January-February. Do not cover seed, plants do well in semishade. Grow 50° and sell as 18 or 22 individual cells per flat.

D. Lupine

Perennial, 1,000 S, 30 days, 70° nights, 85° days. Sow January-February. Adequate amount of moisture. Cover seed 1/4 inch with soil. Sell in 18 or 22 individual cells per flat.

E. Poppy (Papaver)

Perennial, variable, 12 days, 70°. Do not cover and place seed flat in dark. Prick seedlings off into 2" jiffy pots to avoid transplanting shock.

F. Rudbeckia (Coneflower)

Perennial, 40,000 S, 3 weeks, 70°. Germination at least 70°. Cover seed lightly. Sow February or March. Sell as 8 paks of 4 or individual cell paks of 18 or 22 per flat.

G. Sedum

Perennial, 400,000 S, 14 days, 70° nights, 85° days. Do not cover seed with soil. Sow January for spring sales as 18 or 22 individual paks per flat.

III. Vegetables

A. Broccoli

6,000-9,000 S, 10 days, 70°. Grow cool and quickly. Sow 4-6 weeks before sales (May 1). Transplant at three leaf stage and grow at 50-55°. Sell in 12 paks of 6 per flat.

B. Brussel Sprouts

7,000 S, 10 days, 70°. Sow March for May 1 sales. Grow cool 50-55° and sell in 12 paks of 6 per flat. Transplant at the three leaf stage.

C. Cabbage

7,000 S, 10 days, 70°. Grow seedlings 4-5 weeks at 60°, harden one week, young plants withstand mild frost. Transplant at three leaf stage into 12 paks of 6 per flat.

D. Cauliflower

7,000 S, 10 days, 70°. Should be sold when young 4-5 weeks old. Grow cool, 60° after germination. Transplant at three leaf stage and sell 12 paks of 6 per flat.

E. Chives

Perennial, 33,000 S, 14 days, 70°. Sow direct into paks, plants saleable in six weeks, grow cool 60°. Cut tops half way off if too tall to thicken plant. Sell as 18 or 22 individual paks per flat.

F. Egg Plant

6,000 S, 14 days, 80°. Require warm soil for germination. Saleable in 6-8 weeks, transplant when true leaves are 1/4 inch across, about 20 days after sowing. Sell as 12 paks of 6 per flat.

G. Onions

9,000 S, 10 days, 70°. Sow direct into paks, grow at 55° night. Saleable in 6-8 weeks. If plants stretch, cut them half way back. Sell in 6 open paks per flat or 12 open paks per flat.

H. Peppers

4,000 S, 10 days, 80°. Need warm temperature to germinate. Saleable in 6-8 weeks. Grow seedlings at 62° nights, 70° days. Transplant when first true leaves appear. Sell in 12 paks of 6 per flat.

I. Tomatoes

8,000-11,000 S, 7-14 days, 80°. Plants can be sold 6-8 weeks after sowing. Transplant when first true leaves are open. Grow at 60° night temperature. Sell in 12 paks of 6 per flat.

J. Herbs

Germinate with 70° bottom heat, transplant as soon as true leaves are opened. Grow at 62° minimum. Sow 8 weeks before sales in 18 or 22 individual paks per flat.

1. Dill

   1,600 S

2. Sweet Majoram

   134,000 S

3. Parsley

18,000 S, 15-20 days, 80°. Slow germination. Transplant three weeks after germination, saleable in ten weeks. Can be sold year around in 4-inch pots.

4. Thyme

124,000 S

5. Sage

3,000 S

IV. Flowering Pot Plants

A. African Violets

Allow about 8 to 10 weeks for petiole cuttings (36 per square foot) to produce plantlets (2-3 plantlets per cutting). Allow about 10 to 12 weeks for growth of plantlets after transplanting to cell paks (36 per square foot) and about 10 to 12 weeks in 4" violet pots. Maintain 70° night temperature and 75-80° day temperatures. When flower stems are visible finish at 68°. A 1:2:1 soil mix with 6# dolometic lime and 3# 0-20-0 per cubic yard is used. About 100 ppm of high-nitrate-nitrogen for feeding is recommended. Space pot tight up to last 5 weeks then use 6" x 6" spacing. Disease and insect control is quite varied.

B. Calceolaria (Pocketbook Plant)

Annual, variable, 16 days, 70°. Sow, no covering. Light and constant 70° temperature high germination. Avoid keeping soil too wet after seedlings are up. Grow 48-50°. Shade from sun in spring. Sow October 1 for Mother's Day.

C. Christmas Cherries

Annual, 12,000 S, 15 days, 70°. Sow February for Thanksgiving to Christmas sales. Soil temperature must be kept at 70° or above. Expose seed to alternate light and dark. Do not cover. Grow at 50° temperature, Plant 4" pots. Pinch occasionally but not after July 1. Pot September 1 in 6" pots for large specimen plants or sell in 4" pots.

D. Christmas Peppers

Annual, 9,000 S, 12 days, 70-80°. Sow April to July for Christmas season sales. Finishing 1 plant in a 4" pot or 3 in a 6" pot. Grow at 60°. Pinching may be necessary for sturdiness.

E. Cineraria

Annual, 150,000 S, 10 days, 70-75°. Sow August-September for February-April sales. Soil temperature must be kept at 70° or above. Grow at 60°. Pot into 5 or 6 inch pots holding back on the water. As they show buds give ample water, light feeding and protect from strong sun.

F. Gloxinia

Annual, 800,000 S, 2-3 weeks, 65-70°. Light helps germination. Sow December-early January for June flowering. June 1 for Christmas and July 15 for Valentine's. Prick off seedlings into 6" pots, grow at 65-70° with light shade.

G. Kalanchoe

Annual, variable, 10 days, 70°. No soil cover. Maintain constant soil temperature. Greatest demand from November through February. Sow seed from January till June. Three plants make a full 6-inch pot, or sell one plant per 4-inch pot. Normally flowers in January at 60° night temperature. For Christmas flowering shade plants with black cloth for 4 weeks. Starting September 10. For Thanksgiving flowering, shade from late August to late September. No pinching is necessary generally. Plants can also be started from leaf cuttings.

H. Primula

Perennial, 28,000, 3-4 weeks, 70°. Sow seed in August for 3 or 4-inch pots from February thru April. Sow using a 1:1 sand-peat medium at 70° soil temperature. Do not cover seed as germination enhanced by light. Transplant into 2" cell paks and when pot bound into 4" pots. Grow at 45-50°. Limit feeding.

I. Poinsettias

Purchase rooted cuttings for September delivery. Use Annette Hegg varieties for greatest reliability. Minimum night temperature is 60° with 80-85° day temperatures. Both pinching and nonpinching varieties are available. Give plenty of spacing.

Cutting--Propagation and Pinching Dates*

Pot Size & Form	Direct Rooting in Finish Pot	2½" Pot Rooting	Pinch
7"-SS-5-7 Plants	Sept. 1	Aug. 25	
7" Br 1-3 Plants	Aug. 17	Aug. 10	Sept. 7
6" SS-3-5 Plants	Sept. 1	Aug. 25	
6" Br 1-2 Plants	Aug. 20	Aug. 13	Sept. 15
5" SS 3-5 Plants	Sept. 1	Aug. 25	
5" Br 1-2 Plants	Aug. 20	Aug. 13	Sept. 15
4" SS 1 Plant	Sept. 22	Sept. 15	
4" Br 1 Plant	Sept. 7	Sept. 1	Sept. 21

SS = Single stem; Br = Branched

*Source: Ball Red Book, George J. Ball, Inc., 12th ed., 1973, p. 415.

J. Easter Lily

Lilies should be potted 2" deep in 6" pots in well drained soil, 1:1:1 or 1:2:1 mix about 120 days before Easter. Maintain night temperatures of 60° and 75-75° day temperatures, beginning 100 days before Easter. Lilies can be started pot tight and spaced 10" x 10" when plants reach 10" high.

V. Foliage Plants

A. Nephthytis

Creeping or climbing varieties available. Likes high light intensity. Night temperature 65-70° and day 75-85°. Pinch off long stems at any season increase branching and foliage markings. Pinchings can be used for rooting. Sell in 4"-6" pots of 6"-8" hanging baskets, 3 months to 4½ months to sales.

B. Peperomia

Grow on dry side. Indirect or curtain-filtered sunlight is best. Night temperature 65-75° and day, 75-85°. Propagate from leaf and/or stem cuttings, 3-4 months for saleable 4" pots.

C. Hypoestes

Annual, 18,000 S, 7 days, 70-75°. Sterile media, cover lightly with soil. Produced in 12 weeks with one plant per 4" pots. Pinch once or twice (can be rooted) and grow at 55-60° night temperatures.

D. Asparagus Fern

Bright indirect or curtain-filtered sunlight is best. Night temperature 50-55° and day temperature of 68-72°. Keep soil barely moist at all times. Propagate at any season by dividing the thick fleshy roots of old plants or from seed. Seed is hard to germinate and grow requiring about 14 months till saleable. Sell in 4" or 6" pots and 6" to 10" hanging baskets. Do not cut back or pinch.

E. Philodendron

Does best in bright indirect or curtain-filtered sunlight. Night temperatures of 65-70° and day temperatures of 75-85°. Keep soil barely moist at all times. Propagate at any season from stem cuttings from sections of main stems or by the method known as air layering. Four months to produce 4" pots of most varieties. Sold as 4-6" pots and 6-10" hanging baskets.

F. Schefflera

Does best where they get four or more hours a day of direct sunlight, or where artificial and natural light average 800 foot candles over 12 hours a day. Night temperatures of 65-70° and day temperatures of 75-85° are ideal. Keep the soil moderately dry between thorough waterings. Sold in 4-6-8 and 10" pots. Requiring 4-8 months growing time.

G. Ferns (Maidenhair, Boston, Bird's Nest)

The ferns do best in bright indirect or curtain-filtered sunlight; if only artificial light is available, provide at least 400 foot candles. Night temperatures of 50-55° and day temperatures of 68-72° are ideal. Keep the soil barely moist at all times. Established plants should be fed twice yearly, in early spring and mid-summer, with standard houseplant fertilizer diluted to half the minimum strength recommended on the label. All of the ferns described above are sterile--that is, they are incapable of producing spores, the dust-like reproductive particles of ferns. However, in spring they send out shoots, or runners, that root as they creep along the top of the soil and by early summer form new plants that can be cut off and potted. You can also propagate Boston ferns by dividing the roots of old plants in early spring. Probably easier to purchase 2-2½" potted ferns and move to 4" pots for resale in 8 weeks. You might also develop a propagation bed and pot up young plantlets. Soil as 4-8" pots and 6-10" hanging baskets. Larger sizes require up to 5 months.

H. Chlorophytum (common Spider Plant, Ribbon or Bracket Plant)

Spider plants do best in bright indirect or curtain-filtered sunlight; if only artificial light is available, provide at least 400 foot-candles. Night temperatures of 50-55° and day temperatures of 68-72° are ideal. Keep the soil moist at all times. Propagate at any season from the plantlets along the stems or by dividing the fleshy roots. Sell in 4-6" pots and most commonly in 8 or 10" hanging baskets with one plant per basket. Three to four months produce strong 10" baskets.

I. Tolmiea (Piggy Back Plant)

Piggy Back plants do best in bright indirect or curtain-filtered sunlight; if only artificial light is available, provide at least 400-foot candles. Night temperatures of 40-55° and day temperatures of 55-70° are ideal. Keep the soil moist (not over wet or over dry). Propagate at any season from leaves on which a plantlet has formed; insert about 2 inches of the leaf stem into sand, or sterile medium with the base of the leaf resting on the sand. Requires 4 months for 4-6" pots and another 4 weeks for 6-10" hanging baskets.

J. Ivy (Swedish)

Swedish ivies do best in bright light, indirect or curtain-filtered sunlight; if only artificial light is available, provide at least 400-foot candles. Night temperatures of 60-65° and day temperatures of 65-75° are ideal. Keep the soil barely moist at all times. Pinch off long stems at any season to encourage dense branching; these tips can then be rooted to make new plants. Sell as 2½, 4, or 6" pots or as 6-8-10" hanging baskets. About 6 weeks for 2½", 10 weeks for 4" and up to 4 months for 10" hanging baskets.

K. Aralia (Polyscias)

Do best where they get four or more hours a day of direct sunlight, but will grow fairly well in bright indirect light, such as that reflected from light walls. They do fairly well where artificial and natural light average 800-foot candles over 12 hours a day. Night temperatures of 65-70° and day temperatures of 75-85° are ideal. Increase the humidity to 50% or more by placing the plants on a tray filled with pebbles and water. Keep the soil barely moist. Propagate at any season from stem cuttings. Requiring 4 months or more for good quality 4-6" plants.

L. Wandering Jew

Saleable in 4 weeks to 4 months depending on size. These do best in bright indirect or curtain-filtered sunlight. If only artificial light is available provide at least 400-foot candles. Night temperatures of 65-70° and day temperatures of 75-85° are ideal. Keep the soil barely moist at all times. Propagate plants at any season from stem cuttings. Need continual pinching to thicken plants. Sold in 2½, 4 and 6" pots and 6" thru 12" hanging baskets. Use many plants per basket.

M. Pilea (Aluminum Plant, Watermelon Pilea)

Pilea species do best in bright indirect or curtain-filtered sunlight; if only artificial light is available, provide at least 400-foot candles. Night temperatures of 65-70° and day temperatures of 75-85° are ideal. Keep the soil barely moist at all times. Because old plants become straggly, it is best to start new plants from stem cuttings or by dividing the roots. Sold in 4" pots.

APPENDIX B

COST ANALYSIS INFORMATION

I. Analysis--General Information

(This is general information which can be used if none is available locally. If possible, students should use catalogs listed in the Instructional Materials section for up-to-date information and prices.)

Soil Mix Costs $40.00/cu. yard

Although soil is affected by the looseness of soil mix, packing, and similar factors, the following information serves as a guide in soil preparation.

Size of Pot	No. Pots/cu. yd.
2½"	7,000
4"	1,500
6"	410
Flats (2 sq. ft.)	135

Container Costs

2½" pots	$21/1,000 delivered
4" pots	$23/400 delivered
6" pots	$20/150 delivered
Open flats	$36/100 delivered
Cell paks (12/6)	$27/100 sheets delivered

Heat Costs 10¢/sq. ft./month

Overhead Costs 25¢/sq. ft./month

Fertilizer (using osmocote) @ 15#/cu. yd. of soil mix - $28.00/50# bag delivered

Insect Control - Temik, 2 applications at 30 ounces/1,000 sq. foot of pots. $79.00/40# delivered

Wholesale Price

2½"	35-40¢
4"	Flowering - 70¢, i.e., Geraniums Foliage - 85-95¢ African Violet - $1.25
6"	Flowering - $2.00 Foliage - $2.25
Bedding Begonias, Impatiens	$7.00/flat
Others	$4.00/flat

II. Analysis--Sample Problem

Calculate the labor income from 400 square feet of bench space used to grow 4" foliage plants. Use osmocote, 1 application of Temik and 9¢ for rooted cutting with one cutting per pot. Figure pot to pot for 6 weeks and 6" x 6" spacing for 6 weeks.

		Per Pot
Pot Costs:	$23/400 =	5.75¢
Soil Costs:	1500 pots/cu. yd. @ $40.00	
	1500/4000	2.66¢
Fertilizer Costs:	15#/cu. yd. @ ($28.00/50# bag)	
	15#/cu. yd. @ 56¢/# = 8.40	
	1500 pots/$8.40	0.56¢
Temik Costs:	400 sq. foot @ (30 ou./1000 - $79/40#)	
	400 sq. foot @ 30 ou./1000 = 12.4¢/ou.	
	400 sq. foot @ 3.72¢/1000 = .37¢/sq. ft.	
	9-4" pots/sq. ft. @ .37¢/sq. ft. =	0.04¢
Overhead Costs:	@ 25¢/sq. ft./mo. for 6 weeks	
	9-4" pots/sq. ft. @ 38¢ (6 weeks)	4.20¢
	4-4" pots/sq. ft. @ 38¢ (6 weeks)	9.50¢
Heat Costs:	@10¢/sq. ft./mo. for 6 weeks	
	9-4" pots/sq. ft. @ 15¢	1.66¢
	4-4" pots/sq. ft. @ 15¢	3.75¢
Cutting Costs		9.00¢
	Total Costs	37.1¢/pot
	Sales Price	90.0¢/pot
	Labor Income	52.9¢/pot

Using the 6" x 6" final spacing - 400 square feet will grow 1,600 pots @ 52.9¢/pot labor income to produce $846.40 labor income, or $2.11/sq. foot for 3 months or 70.3¢/sq. ft./month.

III. Analysis--Sample Data and Information

If local information is not available the following will be of value for your students when calculating cost-analysis for the problems listed under "Learning Activities."

A. African Violets

Allow about 8-10 weeks for petiole cuttings (36 per square foot) to produce plantlets (2-3 plantlets per cutting). Allow about 10-12 weeks for growth of plantlets after transplanting to cell paks (36 per square foot) and about 10-12 weeks in 4" violet pots. Maintain 70° night temperature and 75-80° day temperatures. When flower stems are visible, finish at 68°. A 1:2:1 soil mix with 6# dolometic lime and 3# 0-20-0 per cubic yard is used. About 100 ppm of high-nitrate-nitrogen four feeding is recommended (use osmocote for a simple method of calculating fertilizer costs). Space pot tight up to last 5 weeks then use 6" x 6" spacing.

Disease and insect control is quite varied. For cost analysis purposes use 0.2¢ per pot.

Petiole cuttings cost about 10-12¢ plus 6¢ royalty. Plantlets which can be potted directly into 4" containers and finished in 10-12 weeks cost 44¢ plus 6¢ royalty. Because of the increased temperatures required for African Violets figure 20¢ per square foot per month for heat costs.

B. Easter Lilies

Lilies should be potted 2" deep in 6" pots in well drained soil, 1:1:1 or 1:2:1 mix about 120 days before Easter. Maintain night temperatures of 60° and 70-75° day temperatures beginning 100 days before Easter. Lilies can be started pot tight and spaced 10" x 10" when plants reach 10" high. For cost analysis purposes figure 0.3¢ per pot for insect control, 3¢ per pot fertilizer and 1¢ per pot growth regulator costs. Use a wholesale price of $1.75 for your problem. Lily bulbs cost about 57¢ delivered.

C. Foliage Plants

The following chart is average data to be used in cost analysis problems. If students can get up-to-date local information their results will be a more accurate picture of the profit potential in your area.

	Jade	Piggy Back	German Ivy	Peperomia
Total Prod. Time	4"-14 wks. 6"-20 wks.	4"-10 wks. 6"-16 wks.	10 wks.	10-12 wks.
Night Temp.	60°F.	60°F.	60°F.	60°F.
Soil Mix	1:1:1	1:1:1	1:1:1	1:1:1
*Fertilizer	Osmocotes or other	Osmocotes or other	Osmocotes or other	Osmocotes or other
Light Rgt.	1500-2500 ft. cds.	1500-2500 ft. cds.	1500-2500 ft. cds.	1500-2500 ft. cds.
Spacing	Pot to Pot	6 x 6 last 4 wks.	6 x 6 last 4 wks.	Pot to Pot
**Insect	Use Temik/2 Applications for Cost Analysis Problem (Discussion only)			
Pinching	One	None	One or Two	None
Pot Size	4" or 6"	4" or 6"	4"	4"
Wholesale Price	4" - 90¢ 6" - $2.00	4" - 90¢ 6" - $2.00	Potting - 90¢ Bedding - 60¢	90¢

*One may or may not want to use osmocote with these crops. It is listed here as it is a relatively simple way of determining fertilizer cost per plant.

**While one may or may not use Temik for insect control on these crops it is used here as a relatively simple way of determining insect control cost per plant.

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